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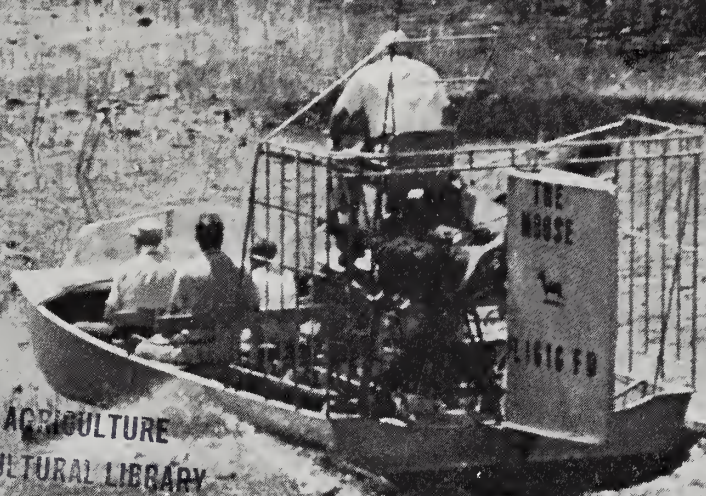
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AUGUST 1969

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CURRENT SERIAL RECORDS



WATER FOR THE RIGHT PLACE
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AGRICULTURAL Research

August 1969/Vol. 18, No. 2

Horatio Alger Crop

A bird's eye view of American farmscapes 40 years ago would have revealed infrequent fields of soybeans, mostly grown for forage or green manure. Today soybeans rank just behind corn as a cash crop and soybeans along with their products are our No. 1 farm export.

Behind this success is a research effort involving scientists of ARS, the States, and agriindustry—a triumph stemming from cumulative advances rather than any single discovery.

The soybean's rise to prominence began in 1930 when USDA plant explorers brought seed-type soybean varieties from the Orient. While plant breeders worked on shattering and lodge resistance, other scientists wrestled with such agronomic problems as nutritive requirements, spacing, and inoculation with nitrogen-fixing bacteria. Keeping pace with this activity, scientists of ARS' Northern utilization research laboratory helped find new uses for soybean oil—in foods such as margarine, shortening, and salad dressing and in paints, plastics, detergents, and industrial chemicals. They employed soybeans to make adhesives, paper coatings, and textile sizings. And they developed methods of processing protein-rich soybean foods for the protein-poor regions of the world.

ARS scientists helped develop a thriving export trade to Japan—a country that a decade ago bought no U.S. soybeans for human consumption—by selecting varieties suited for traditional Oriental dishes and improving ways to ship soybeans without loss of quality.

Problems accompany successes. Although the Northern laboratory helped make soybean oil our major salad and cooking oil, its flavor stability during storage and shipment needs further improvement. This is important since a major avenue for expanded soybean markets lies in satisfying overseas needs for the oil.

Another problem is the invisible "yield barrier" that seems to hold national average soybean yields to about 25 bushels per acre. Some growers, however, consistently top 60 bushels. Better management by growers plus current research embracing genetics, physiology, pest control, and cultural practices will break the yield barrier. The hard everyday work which made soybeans the crop of the century will prevail.

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Clifford M. Hardin, Secretary
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Bakers' quest

WANTED: A high-protein bread that's low in price but tasty and of good texture. A wheat bread like this could go a long way toward meeting the needs of a protein-hungry world.

Flours made from soybeans and other oilseeds are inexpensive sources of proteins but when added as supplements to wheat bread doughs, changes in the dough mixture occur, resulting in inferior breads.

ARS scientists now think that the remedy may lie in glycolipids, complexes of carbohydrates and fats (lipids). Although glycolipids make up only about 0.3 percent of wheat flour weight, they are responsible for desirable breadmaking qualities. They improve loaf volume, crumb grain, and retention of softness.

In tests involving wheat flour that was protein-enriched by the addition of relatively low levels (3 to 6 percent) of soy flour but without added glycolipids, bread was poor in loaf quality. With added glycolipids, a bread acceptable to consumers was maintained.

The tests were conducted by ARS chemists Yeshajahu Pomeranz and K. F. Finney, along with other scientists at the Kansas Agricultural Experiment Station, Manhattan. The scientists also found that replacing 16 percent of the wheat flour with soy flour tripled the amount of amino acids in the bread. Amino acids are components of protein.

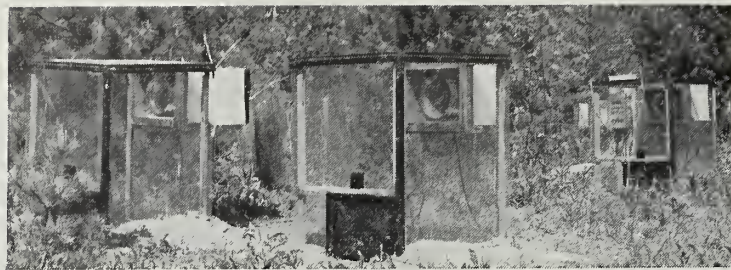
These findings were based on years of study into the biochemical and functional (breadmaking) properties of specific wheat flour components. The studies have also stimulated research on making the proteins of soy flour, fish flour, edible yeast, and other sources functional and compatible with wheat flour proteins in bread doughs, thereby improving consumer acceptance of protein-enriched breads.

The use of glycolipids to produce acceptable, nutritionally improved wheat breads is particularly promising because it can be carried out by existing breadmaking processes and requires practically no change in the formulation, schedules, or equipment. ■



Both loaves contain 16 percent soy flour and weigh 100 grams, but glycolipids were added when making the loaf at left, rendering the soy flour proteins functional and improving loaf volume (PN-1804).

Top: Scientists enclosed 10-year-old diseased pines in plastic-covered chambers with carbon filters to control entry of polluted air (PN-1805).



Bottom: After 3 years of filtration, trees were intensely vigorous (PN-1806), but when filtration was discontinued, susceptible trees again showed chlorotic dwarf symptoms (PN-1807).



Far right: Both trees are 15 years old but tree in front has chlorotic dwarf disease (PN-1808).



pollution dwarfs white pines

AIR POLLUTION is strangling one of our most beautiful and useful forest giants.

At relatively low levels, pollution causes chlorotic dwarf disease in the stately eastern white pine (*Pinus strobus* L.), an important source of lumber in the Northeast and parts of the Midwest. The dwarfing of this species has concerned nurserymen and foresters for some 60 years. Surveys in Ohio alone show that chlorotic dwarf may affect more than 30 percent of the pines in plantations and in young natural stands.

Dwarfed pines have a sickly, mottled yellow color and are much smaller than other pines of the same age—an 8-year-old dwarf may be less than 2 feet tall while a healthy pine of the same age is stretching up over 12 feet. Diseased pines eventually die when they can no longer compete with their more vigorous neighbors.

Discovering the causal agent and how it operates has been the goal of a joint study by plant pathologist L. S. Dockinger of USDA's Forest Service and ARS plant physiologist W. W. Heck, in cooperation with the National Air Pollution Control Administration of the Department of Health, Education, and Welfare at Cincinnati, Ohio.

The scientists have now established that the culprit is either sulfur dioxide, ozone, or an interacting mixture of both gases—primary ingredients in the urban pollution mix.

Healthy but dwarf-susceptible pines developed intense disease symptoms when exposed to mixtures of ozone and sulfur dioxide, each at a concentration of 6 or 10 parts per hundred million (pphm). Serious symptoms also developed in susceptible pines exposed to 6 pphm sulfur dioxide. (Urbanites will not feel discomfort

until oxidant pollution levels reach 15 pphm.) The tested pollution concentrations generally simulated 1966–1968 levels in stricken white pine plantations in the Blue Rock State Forest east of Columbus, Ohio. Diseased pines in the field recovered when enclosed in chambers receiving filtered air.

Fortunately, some white pine trees are genetically resistant to chlorotic dwarf. Forest Service personnel are studying control methods whereby nurserymen can identify and cull latent susceptible seedlings.

Scientists feel that what they have learned in this study may help explain some other white pine needle diseases that occur even when levels of single gases are not high enough to cause damage. Conifers, because of their year-round foliage, are generally more susceptible to air pollution than hardwoods. ■

cue to harvest: POTATO MATURITY TEST

A NEW TEST may tell when potatoes have reached the right stage of maturity to be harvested for processing into french fries, chips, or other potato products.

The experimental test measures the activity of sucrose synthetase, an enzyme in young and growing potatoes that decreases abruptly at a point believed to mark maturity. This enzyme may be involved in the first step of the complex chain of reactions by which sugar is transformed to starch in potatoes and other plants.

At the Red River Valley Potato Research Center, East Grand Forks, Minn., ARS chemist Russell Pressey has purified the sucrose synthetase in potatoes and worked out an assay method for it.

Pressey's test is based on the ability of this enzyme to catalyze the transformations in the potatoes between sucrose and the simpler sugars fructose and glucose. Under an alkali-

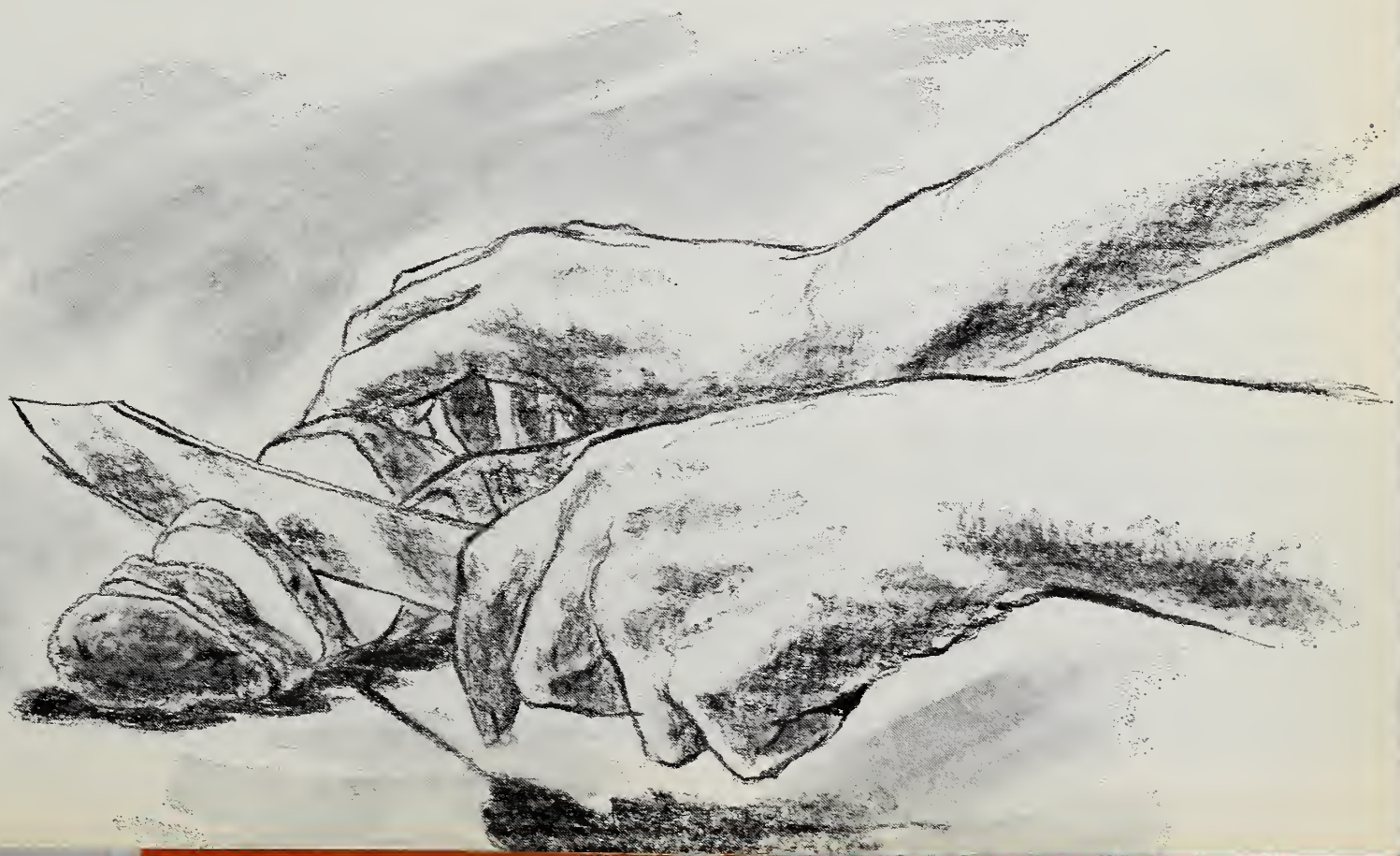
line condition (pH 8.8), sucrose synthetase triggers the synthesis of sucrose from these sugars; under an acid condition (pH 6.6), it catalyzes the cleavage of sucrose into fructose and glucose. Since both the synthesis and the cleavage can be observed experimentally, they provide tests for sucrose synthetase. The cleavage test is somewhat preferred, since this reaction proceeds more efficiently than the synthesis.

Much work remains to be done before the exact mechanism of this enzyme reaction will be understood. But Pressey's research has shown at least what sucrose synthetase does, so that by observing in the laboratory the extent of sucrose cleavage or synthesis that takes place in the presence of a potato extract under precise conditions, the amount of enzyme present can be deduced.

By performing this test at weekly intervals from late July to the begin-

ning of October on Kennebec and Norchip potatoes that had been planted in May, Pressey observed that the youngest potatoes had the highest sucrose synthetase content. As potatoes developed, he noted a gradual decrease in the enzyme until a time that may correspond to maturity, when it fell off abruptly.

In its present form, the test for sucrose synthetase is too complicated and time-consuming to be used as a routine test for potato maturity. Moreover, these experiments were made on only two potato varieties. Reliability of the test awaits confirmation in further, more extensive work on other varieties. If the preliminary indications are borne out, however, the principle might provide the basis for a quick, simple test for routine use. Such a test would enable potato growers to harvest their crop at the peak of maturity when potatoes are most suitable for processing. ■



Inverted cone trap is used in field tests of screwworm attractants (BN-33837).

for
screwworm
fly surveys



LURES TO IMPROVE THE CATCH

SCREWWORM FLIES are homing in on experimental lures that attract fewer unwanted species of insects than traditional liver baits.

Better lures are needed to provide a more precise indication of the screwworm fly population. Screwworms are a feared livestock pest in the Southwest. Both of the usual detection methods—samples of fly larvae obtained from livestock and flies'

response to liver baits—serve as a useful warning, but neither indicates the size of the population. Consequently, control measures may be inadequate in some areas and wasted in others inhabited by fewer flies.

In tests at Mission, Tex., by ARS entomologists G. W. Eddy, W. S. Bigley, and Joyce De Vaney, some fractions, or components, of cows' blood attracted screwworm flies more read-

ily than other fractions. One promising blood fraction attracted 3,200 screwworm flies in an hour. By comparison, liver baits usually attract only a small fraction of that number in a 24-hour period. Because the experimental lures also attracted fewer unwanted species of insects, they were more convenient to handle.

The entomologists are now trying to learn what these more active fractions contain in order to isolate the active substance and incorporate it in a bait.

In addition, the material will be tested for stability. Practical requirements call for trap analyses about once a week—a period in which the lure should not deteriorate and lose its ability to attract the flies.

Entomologists will also determine the distance over which the lure attracts screwworm flies, thereby indicating how many traps would be needed for a given area. Effects of various climates and weather conditions on insect responses will also be studied.

Screwworms are the target of a non-chemical control program—one in which millions of the insects are mass-reared, sterilized, and released to mate with the native flies, which then produce infertile eggs. Because of the unusually large number of wild flies present in 1968, and so far in 1969, control officials have been forced to push the control program to the limit that funds allow. Program officials believe that such emergencies might be met at considerably lower cost—and with fewer sterilized flies—if lures become available to pinpoint areas that would require greater or smaller than usual control efforts.

Another potential for lures may be their use in combination with chemosterilants or insecticides. The potential for these applications will be determined in future research. ■

Left: Attracted flies rest on the container of experimental lure. The container is usually placed inside a trap (PN-1811). Right: Screwworms infest ear of steer. An untreated, grown animal may be killed in 10 days by thousands of maggots feeding in a single wound (PN-1812).



promising control for **TURKEY CHIGGERS**

DOWNGRADING of turkeys because of mite damage could be minimized with a recently tested experimental pesticide.

Mites can cost producers as much as \$1 per turkey, depending on the size of bird, extent of damage, and other factors. In Texas alone, almost half of the birds downgraded at processing plants are singled out because of skin lesions caused by the mites, commonly called turkey chiggers (*Neoschongastia americana*). Grow-

ers have been dissatisfied with available control measures—treatments as frequent as once a week are necessary and the equipment can frighten the birds, causing stampedes and injuries.

In contrast, ARS entomologist S. E. Kunz, at Kerrville, Tex., found that a single treatment with Dursban, one of the most promising of several experimental miticides, was effective for 6 weeks when sprayed on the ground in a 1-acre turkey range. None of the birds developed skin lesions large enough to cause downgrading.

In later Dursban tests, Kunz sprayed a 75-foot-square pen area, then placed turkeys in the pen. Examination at time of slaughter, 4 weeks later, indicated that only 10 percent of these birds would have been downgraded. However, 90 percent of the turkeys held in nearby untreated pens developed serious lesions.

Based on prices in effect at the time, downgrading would have reduced the market value of the infested birds by \$413.50 for a flock of 500 turkeys similar to those used in the experiments.

In a related study to pin down the significance of turkey chiggers to the

poultry industry, Kunz, ARS entomologist O. H. Graham, and Texas A & M entomologist M. A. Price found that uninfested turkeys put on ranges not occupied by turkeys for 2 years attracted chiggers within 24 hours. In the absence of turkeys, chiggers may survive on rabbits, rats, shrews, prairie dogs, at least 15 kinds of wild birds, and even on lizards.

Feeding sites on turkeys started by a single chigger attracted additional chiggers, resulting in large clusters of the pests at each infestation site. Untreated birds often had 25 to 30 lesions large enough to cause serious downgrading.

Chiggers feed up to 2 weeks before dropping off the birds; lesions require an additional 3 to 4 weeks to heal. The slow rate of healing and the change to year-round marketing are major reasons for the pests' economic importance. Chiggers are most active—and cause the biggest problem—during the warm months.

Dursban (*O,O*-diethyl *O*-3,5,6-trichloro-2-pyridyl phosphorothioate) is still an experimental material for chigger control and is not yet commercially available for this use. ■



Left: Skin lesions caused by turkey chiggers must be trimmed from dressed birds, resulting in downgrading by inspectors (BN-33813). Above: Typical skin lesions in undressed birds caused by chigger infestations (BN-33812).

Cover: Airboat carries tourists through Loxahatchee Recreation Area in Conservation Area No. 1. Water storage is primary purpose of conservation areas, but regulatory levels are designed to give wildlife preservation top consideration (ST-4852-7). Left: Lindahl, Shinha, and Hamrick enter data into computer at FCD office, West Palm Beach (ST-4845-9). Center: Lindahl indicates flow from Lake Okeechobee to the Everglades to Nagendra Khanal from Nepal who is studying FCD procedures (ST-4845-3).



Center above: Taylor Creek as it enters Lake Okeechobee (ST-4851-15). Left: On creek tributary, Speir measures depth of flow over weir to determine water flow rate (ST-4848-22). Above: Pumping Station No. 6 lifts water from surrounding land into Conservation Area No. 1 (ST-4852-8).

WATER

LANDSCAPE and climate combine to batter southern Florida with wind and water. The region's flat face of peaty and mucky soils has high water tables and is drained by sluggish, shallow streams. When torrential rains come—rainfall averages nearly 60 inches a year—natural drainage cannot cope with the overflow.

Twice in the 1920's, hurricane-blown walls of water swept out of Lake Okeechobee, claiming almost 2,500 lives. And in 1947 tropical storms poured 100 inches of water on the region and turned 90 percent of it into an inland sea. Damages totaled over \$41 million.

Nature no longer holds sway, particularly since creation of the Central and Southern Florida Flood Control District (FCD). Although more than 40 inches of rain fell within 60 days last year, there were no floods and but little damage. The overflow was safely channelled away by canals, levees,



Below: ARS hydrologist J. E. Browning checks sensory device that records downstream water depth and current at tainter gate on Taylor Creek. Device punches information onto tape which is then fed into FCD computer. ARS hydrologist Ronald Alberts adjusts gate controls (ST-4849-14).



or the right place and time

pumps, and other structures built by FCD. For along with flood control, FCD provides water control by storing the overflow in Lake Okeechobee and three giant water conservation areas in the Everglades. During dry periods, the stored water fills urban, agricultural, and industrial needs and replenishes Everglades National Park.

Now the FCD is going a step further—an ARS-designed computer model is being incorporated as a tool for planning and managing water resources. The model is a system of equations and data fed into the computer. Hopefully, one operator sitting at the computer will someday open and close structures throughout the District—18 counties covering 15,673 square miles and three times the size of Connecticut, changing the water elevations in various basins, and providing detailed hydrological data.

FCD must think not only in terms of flood control, but also of fishery and wildlife values, weed control, rec-

reational and navigational use, water-quality control, domestic water supply, irrigation, and esthetics. The number of possible water-management decisions is staggering. Without a computer model, by the time all the data necessary to make a decision is analyzed “by hand,” it would be too late to act. A computer system will provide hours or days of warning for decision making.

The Florida engineers chose the ARS model because soil moisture capacities and plant use requirements needed for input data are readily obtainable from soil surveys by USDA’s Soil Conservation Service and from long-term cooperative hydrologic studies at Fort Lauderdale by ARS and FCD.

In developing the model, thousands of soil samples plus scores of hydrologic records were collected from more than 200 agricultural watersheds over the United States and analyzed by the USDA Hydrograph Labora-

tory, Beltsville, Md., under the direction of ARS hydrologist H. N. Holtan (AGR. RES. Nov. 1965, p. 3). With these analyses, ARS scientists produced a computerized technique for predicting how much of the rain (or snow) falling on the agricultural watersheds will go to plant use, evaporation, surface runoff into streams, and to ground water recharge.

With the help of ARS, it won’t be long before FCD engineers R. L. Hamrick, L. E. Lindahl, and L. K. Shinha under the direction of W. V. Storch will have this model applied to the Kissimmee River Basin. If results turn out as expected, the engineers will apply the model to the Upper St. John’s Valley and possibly to the entire Flood Control District.

Eventually, telemetric systems will make possible the operation of mechanical devices such as tainter gates by radio beam from a main office. Telemetric systems will also feed back information from rain gauges, stream-depth gauges, groundwater gauges, and similar recorders to a tape-punching machine that, in turn, can feed the information into the computer without manual processing.

The proposed plan has already started imaginative Florida minds thinking not only of the physical computer model but of a prediction model and an economic model. The prediction model would, as the name suggests, forecast storm events and the response of the watershed under given conditions. The economic model would provide data about the economic consequences of various policy decisions.

Tests of a computer model of Taylor’s Creek by ARS hydrologists J. C. Stephens and W. N. Speir against actual data from the experimental watershed have come up with extremely satisfactory results.

Holtan, along with Stephens and Speir of Fort Lauderdale, will work with the FCD to further adapt the model to Florida conditions. ■

QUICK TEST

diagnoses fertility problems

REPRODUCTIVE problems of animals and man may be diagnosed quicker and better with a new test that uses rats as reactors.

The strong point of the test is its extreme sensitivity; it can detect as little as 25-trillionth of a gram of estrogen in a one-tenth milliliter sample. Checks on estrogen are important, for without this hormone, the reproductive cycle of the animal cannot

function and pregnancy cannot occur.

The new test was developed by T. R. Wrenn, J. R. Wood, and Joel Bitman, biological scientists in ARS' Hormone Physiology Laboratory, Beltsville, Md. Basis for the new test is their discovery that estrogen acting in the vagina raises the concentration of glycogen, a long string of sugar molecules. This rise seems to precede other changes in the reproductive tract caused by estrogen. Some of these changes form the basis of existing estrogen assay methods.

Rats make good reactors for the vaginal glycogen test because they do not react adversely to injections of blood, urine, and other materials likely to be tested for estrogen content. Best subjects are 40-day-old females with their ovaries surgically removed. After a 10- to 12-day wait to let estrogen manufactured by the excised ovaries disappear from the rats' system, the scientists inject a test sample directly into the vagina. Only one injection is needed per animal.

Five hours after injection, glycogen in the rat vagina is extracted, color reagent is added, and the mixture is stirred and heated. Intensity of the

resulting color is read on a spectrophotometer, indicating the amount of estrogen present.

Answers are precise and specific. Compared to common existing estrogen assays, the new method is 100 times as sensitive. And the new method is so specific in its detection that other hormones, such as progesterone and cortisone, elicit no response whatever.

The vaginal glycogen test could be applied to treating reproductive problems. For example, it could be used to monitor estrogen output of females that fail to conceive or as a check on pregnant mothers. Furthermore, the new test is tailor-made for basic studies in reproductive physiology, since it measures the active hormone level absorbed into the circulating system rather than the secretion level of the glands.

The test also offers an approach for pregnancy detection in farm animals. Researchers found that urine from a cow in the ninth month of pregnancy has an estrogen level 10 times that of a nonpregnant cow. (The ARS team did not make checks on estrogen level earlier in pregnancy). ■

Wrenn (left) holds female rat in position while Wood injects blood samples into its vagina for glycogen test of estrogen content. The team of Wrenn and Wood can inject a batch of 25 rats in 5 minutes (ST-4554-4).





Far left: Veterinarian L. G. Classick takes blood sample (PN-1813). Above: Technician D. M. Trump makes white blood cell count to determine extent of illness in infected calf (PN-1814). Left: He tests for presence of virus-neutralizing antibodies in calves (PN-1815).

VIRUS causes calf scours

VIRUSES, not just bacteria, can cause calf scours.

ARS veterinarian George Lambert and microbiologist A. L. Fernelius showed this with newborn calves at the National Animal Disease Laboratory, Ames, Iowa. Similar findings were reported by University of Nebraska scientists. The ARS researchers fed or instilled bovine diarrhea virus into the nose of 13 calves. All got sick, and four died from scours.

In addition to the virus, enteric bacteria were isolated from bodies of calves that died. But when bacteria from the dead calves were fed to four other calves, no sickness resulted.

ARS scientists concluded, therefore, that the four dead calves had been killed by viruses, not bacteria. But they emphasize that their work had been done under laboratory conditions. On the farm, enteric bacteria generally complicate scours cases, and treatment against bacteria may help calves survive.

Proof of viral involvement in calf scours opens the door to prevention of this disease in young animals. Previously, virus diarrhea had not been regarded as a disease of adult cattle and most living virus vaccines are not recommended for pregnant cows or calves under 4 weeks old. ARS re-

searchers now have as their goal a safe, noninfectious vaccine that would give immunity to cattle of all ages.

They note that the 13 calves exposed to bovine diarrhea had been raised only on artificial milk replacer. Eight other calves, similarly exposed to viruses but fed mother's milk, showed much milder symptoms whether or not the milk contained colostral antibodies. Only one died and its mother's milk did not contain viral antibodies. Field surveys show that 40 to 50 percent of U.S. cows also do not carry antibodies against the virus in their milk—a gap that could be filled by proper use of safe vaccines. ■

TRIGO/boon for California stockmen

Problem: California stockmen urgently need to increase the carrying capacity of dry grazing land. At the same time, public agencies need to improve and maintain a good cover of vegetation for conservation purposes.

Reasons: The State's irrigated pasture acreage has tripled in the past 20 years. Ten acres of dryland range for each acre of irrigated pasture is the currently desired balance on livestock ranches, but the amount of dry grazing land has declined. Urbanization has forced farmers out of the valleys where grazing formerly predominated and into the foothills.

Solution: An adapted grass for seeding and a method of establishment that should increase the productivity of remaining dry grazing land. ARS and the Department of the Interior's Bureau of Land Management (BLM) have the grass and the method.

Only the most hardy species are adapted to the inhospitable climate of central California's drier foothills. Annual precipitation averages 6 to 15 inches, most of it occurring from November through March. Droughts are frequent; in one 12-month span, only 4½ inches of rain fell on the seeding experiment established by ARS range scientist D. R. Cornelius and BLM range conservationist G. D. Burma.

Trigo pubescent wheatgrass proved the best adapted of 21 species drilled on burned-over, extremely dry chamise bushland in 1961. When judged for vigor, stand, and productivity on a 0 to 10 scale, Trigo received a numerical rating of 9 in 1967.

Nodding needlegrass, a native species, received a rating of 8 but obtaining seed for propagation of this



Cornelius examines seed of Trigo pubescent wheatgrass which was supplied by USDA's Soil Conservation Service. The grass is native to U.S.S.R. (Photo: Courtesy of FRESNO BEE News).

species is difficult. Only 11 of the 21 species became established, and six of these had a lower productivity rating in 1967 than in 1962.

In related experiments at another location, Cornelius and Burma were more successful in establishing Trigo wheatgrass in deep, wide furrows than in shallow, close-drilled furrows. Seedlings in the deep furrows had some protection from drying winds and were shaded by the ridges at certain times.

These experiments also indicated that November seeding, soon after the first fall rains, gave a significantly

higher seedling establishment than drilling in January, after half of the limited rainfall had been received.

Fall sowing also exposed Trigo wheatgrass seed to soil temperatures favorable for germination. Under controlled temperatures in the laboratory, the highest germination of Trigo was obtained at 35° to 40° F.—temperatures similar to those found in the field in November.

The scientists concluded that Trigo pubescent wheatgrass, fall-seeded in deep, wide furrows, holds promise for improving dry grazing land in the drier foothills of central California. ■

LIKE a bloodhound tracking a fugitive, a device incorporated onto a cotton planter "sniffs out" a good, moist environment and positions the planter where seeds can be expected to get a good start.

Called a moisture-seeking control, the device is mounted directly behind the soil blade in contact with the newly exposed soil surface. It works by an electric circuit across the soil and employs the entire planter as one electrode. The device itself is the other. Changes in electrical resistance caused by differences in soil moisture levels are "sensed" by the device, which moves the planter up or down as it passes over wet or dry areas. The device controls the up and down movement hydraulically through solenoid valves. Temperature, salt content, and other variables within the soil also affect electrical resistance.

ARS agricultural engineer L. M.

Carter at Shafter, Calif., developed the device and says it can raise or lower seed depth within 1 percent of the set depth to find the best moisture condition. As the planter moves across the field, the device automatically adjusts the set depth to the gradual change in moisture levels at a rate of about 1 inch in 6 feet of row.

Carter, in cooperation with the California Agricultural Experiment Station, Davis, is making the study because irrigated fields are not, in general, uniform in soil texture or moisture. The shape of the bed and the moisture distribution within the bed vary under most field conditions due to preplanting irrigation, whether sprinkler or furrow.

To test the device, Carter irrigated a field with a sprinkler system that had only one head out of three operating to produce an uneven soil moisture situation. The planter was operated

with various control settings, and soil samples were taken immediately for analysis of moisture content.

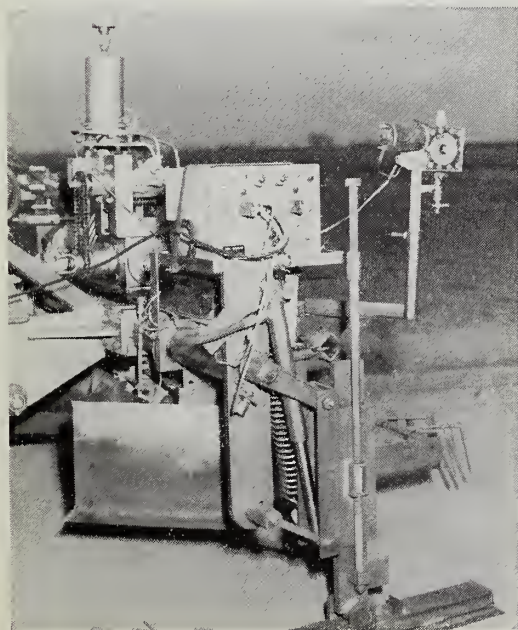
Part of the study included a modification of the standard three-point hitch used on tractors when pulling implements. The disadvantage of the three-point hitch is that as the tractor wheels follow the irregularities of the furrow, the attitude of the tractor and planter changes by constraint of the hitch. The result is noticeable in depth of seeding and the actions of the firming wheel and covering devices.

To get around this problem, Carter and his co-workers substituted a hydraulic ram with a pressure chamber for the normal third or upper link. It makes the forces on the sled or planter independent of the attitude of the tractor; yet, the sled can be carried on the tractor for turning or transport. This system proved highly practical under field conditions. ■

PICKY PLANTER

Left: Planter with moisture-seeking control (PN-1816).

Right: Experimental unit for attitude control of three-point mounted sled (PN-1817).



Wider horizons for sourdough

MANY of San Francisco's visitors rate the Golden Gate Bridge well behind sourdough French Bread as a tourist attraction.

The bread is so popular that countless attempts have been made to bake it elsewhere, but for more than 100 years the "real McCoy" has been made only in the San Francisco Bay area.

The long wait may be nearly over for sourdough lovers in other parts of the world. Making the bread is now under investigation by biochemist L. Kline and microbiologist T. F. Sugihara at the ARS Western utilization research laboratory, Albany, Calif.

"It's almost unbelievable," says Kline, "that with a food this popular, an attempt has never before been made

to get a scientific understanding of what gives the bread its unique character. It isn't enough just to know how the San Francisco bakers handle their dough and manage the oven."

The researchers are concerned primarily with determining what kind of microorganisms are active, exactly what their functions are, and how to make them available in easy-to-use form. Kline foresees products that will be packaged and distributed in much the same way as baker's yeast or as frozen or refrigerated cultures.

Kline and Sugihara feel they are "zeroing in" on the microorganisms responsible for the unique sourdough properties. There appear to be two types of microorganisms, and both have some surprises for microbiologists.

The yeasts ordinarily used to cause breads to rise cannot tolerate acetic acid. Sourdough bread is highly acidic, however, and at least half the acid in sourdough bread is acetic acid. But the sourdough yeast lives under these conditions.

Even more unusual than the yeast are the acid-producing strains of bacteria. These appear to have a combination of special nutritional and environmental requirements for growth and do not seem to fit into any known taxonomic group. They are quite different from the lactic acid type of bacteria prominent in sour rye breads.

As happy as sourdough lovers will be if the ARS research is successful and the bread becomes available anywhere bakers want to produce it, another objective of the research is perhaps more economically important. If a way is found to produce and handle the organisms commercially, it may be possible to incorporate a little sourdough with doughs of other breads to give them some of the taste and appeal of sourdough bread. ■



Food technologist Linda Bele puts a loaf of sourdough French bread in a laboratory oven (PN-1818).

Tenderizin' corn kernels

ANYONE who eats popcorn knows the hulls appear well-nigh indestructible. The tough, cellophane-like skins of corn kernels are high in cellulose and have little value as human food.

To remove this indigestible hull, conventional dent corn milling methods grind the hulls with other parts of the kernels, then separate the hulls mechanically. These methods allow some of the nutritious parts to go with hulls into livestock feeds.

To prevent this loss of nutrient, C. W. Blessin, W. L. Deatherage, and G. F. Inglett, chemists stationed at ARS' Northern utilization research laboratory in Peoria, Ill., studied the use of sodium hydroxide solution (lye) in corn dehulling. They found that soaking the corn for 3

minutes in 15 percent lye at 160° F. dissolved the hull while leaving the corn kernel itself in one piece.

The chemists tested lye dehulling of two dent corn varieties obtained from a hybrid breeder and a No. 2 yellow market sample obtained from a Peoria elevator. The corn was tempered to a uniform moisture content, then soaked in lye under a range of conditions.

Lye dehulling removes more than half of the indigestible fiber from the kernel and could be used with conventional corn milling methods. It also enables processing of foods in ways not now possible with ground corn fractions from conventional milling.

Next step in these studies is to mill lye-dehulled corn by otherwise conventional methods. ■

AGRISEARCH NOTES

Fibered Concrete Cuts Costs

Thin sections of concrete reinforced with short steel fibers may someday help cut the cost of constructing houses and other structures.

ARS agricultural engineers J. W. Simons and B. C. Haynes, Jr., say that the addition of steel fibers to concrete is much easier and requires less labor than placing conventional reinforcing. The fibers are the diameter of a small pin and about 2 inches long. Although the technique does not require skilled labor for mixing, it does for placing and finishing the sections.

The engineers are developing the thin sections for possible use in slab-on-grade floor construction and tilt-up wall panels. Slab-on-grade simply means pouring concrete on a compacted earth or gravel base.

Preliminary research at Athens, Ga., in cooperation with the Georgia Agricultural Experiment Stations, indicates that 1-inch panels may be satisfactory.

Tests show that adding 2 percent steel fibers by volume to the mix will double bending strength, as compared to nonreinforced concrete. Moreover, the panels support 20 to 33 percent more weight in compression. Weather exposure limitations are being investigated.

Compared with conventional concrete slab and tilt-up panel construction, the method offers savings through:

- Reduced amount of concrete.
- Reduced labor cost in reinforcing and handling the panels.
- Reduced handling equipment cost.
- Reduced transportation cost.

When the steel fibers become commercially available, successful application of this method of construction may lead to the development of pre-cast utility cores. Perhaps bath and kitchen units can be hauled to the site, set on a foundation, and the house built around them.

DDT Causes Thin Shells

Excessive amounts of DDT can produce thin shells in the eggs of Japanese quail.

In ARS tests, scientists divided virgin Japanese quail into three groups of 14 birds each. The control group received a low calcium diet of chick starter. The other two groups also received the chick starter, but one group received 100 ppm of one form of DDT, ortho-para', while the other

received 100 ppm of para-para' DDT.

The quail on the para-para' DDT diet produced fewer eggs during the first half of the experiment, and their eggs were significantly smaller than those of either of the other groups.

Shell thickness and percent shell calcium in the eggs of both groups receiving DDT showed significant decreases when compared with the control group. DDT also caused a sharp decrease in shell thickness and calcium content of eggs laid successively in clutches by individual birds. Control birds showed only a slight decrease in shell thickness and calcium.

Seed-eating birds would probably never encounter DDT concentrations of the magnitude used in this study. There is some evidence, however, that carnivorous birds could possibly be exposed to high levels of DDT.

Morrison Lecture: Patrick Horsbrugh, professor of architecture at Notre Dame University, gives the second B. Y. Morrison Memorial lecture in Cleveland, Ohio. Speaking before the annual convention of the General Federation of Women's Clubs, he discusses emotional, ethical and ecological responsibilities toward the environment. ARS sponsors the lectures to honor B. Y. Morrison, first director of the National Arboretum. Mrs. W. V. Magee, Federation president, sits at left and G. W. Irving, Jr., ARS administrator, at right (BN-34085).





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AGRISEARCH NOTES

A Closer Look at Carotene

Carrots bred for high carotene content and deeper color may come from recent Public Law 480 research in Israel.

Carotene not only imparts the orange color that influences market value, it also provides essential provitamin A. Despite the importance of carotene, past physiological data on the origin, growth, and protein content of carotene bodies in carrot root have been conflicting. Until recently, for example, scientists were uncertain as to whether carotene bodies are pigment crystals, cytoplasmic particles of many shapes, or both.

The Israeli work, sponsored by ARS, does confirm the crystalline nature of the carotene body and its origin in plastids, as suggested by some previous studies. Plastids are specialized protoplasmic bodies present in nearly all plant cells. Reddish-orange plastids like the ones containing carotene are usually called chromoplasts.

When carotene pigments are extracted from carotene bodies and re-crystallized, the resulting crystals appear identical in shape to the original carotene bodies. Confirmed by the Israelis, this fact is considered evidence that the carotene body shape is determined by a carotene crystal.

The investigators also concluded

that earlier analyses indicating a protein-carotene ratio of about 1:1 are too high. They found that a low-protein content could be expected in the core of carotene bodies. Although protein levels of 22 percent were previously reported, the Israelis found only about 8 to 11 percent protein content and a lower protein-carotene ratio of 1:5.

These studies resolve much of the controversy about the nature of the carotene body. Improved breeding of carrots may come through matching information about known progeny with these new facts. The research was conducted at Hebrew University, Jerusalem; Shimon Klein was principal investigator. G. D. McCollum, plant geneticist, Beltsville, Md., was the ARS sponsoring scientist.

Hybrids That Kill Insects

Four new "hybrid" synthetic ethers have been created that block insect growth and development.

The new compounds are several hundred times more potent than the insects' own hormones or biologically similar synthetic compounds tested earlier (AGR. RES., Dec. 1968, pp. 3, 4).

Although the new chemicals may have potential for pest control, they do not act like conventional insecticides.

As little as 10 nanograms (a nano-

gram is one-billionth of a gram) of the new compounds applied to the abdomen of milkweed bug nymphs and yellow mealworm pupae creates monster insects. Instead of maturing into normal adults, the treated insects become overgrown nymphs and pupae. Some of them combine both mature and immature traits. Merely exposing mealworm pupae to fumes from the compounds produces similar effects. Treated insects are doomed by their abnormalities and die without reproducing.

The new compounds were created by ARS entomologist W. S. Bowers at the Insect Physiology Pioneering Research Laboratory, Beltsville, Md. The most active are the 3,4-methylenedioxyphenoxy ethers of 6,7-epoxygeraniol and their corresponding ethyl-branched homologs.

Ways of employing the new compounds in practical applications remain to be developed.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly



careful where there is danger to wildlife or possible contamination of water supplies.